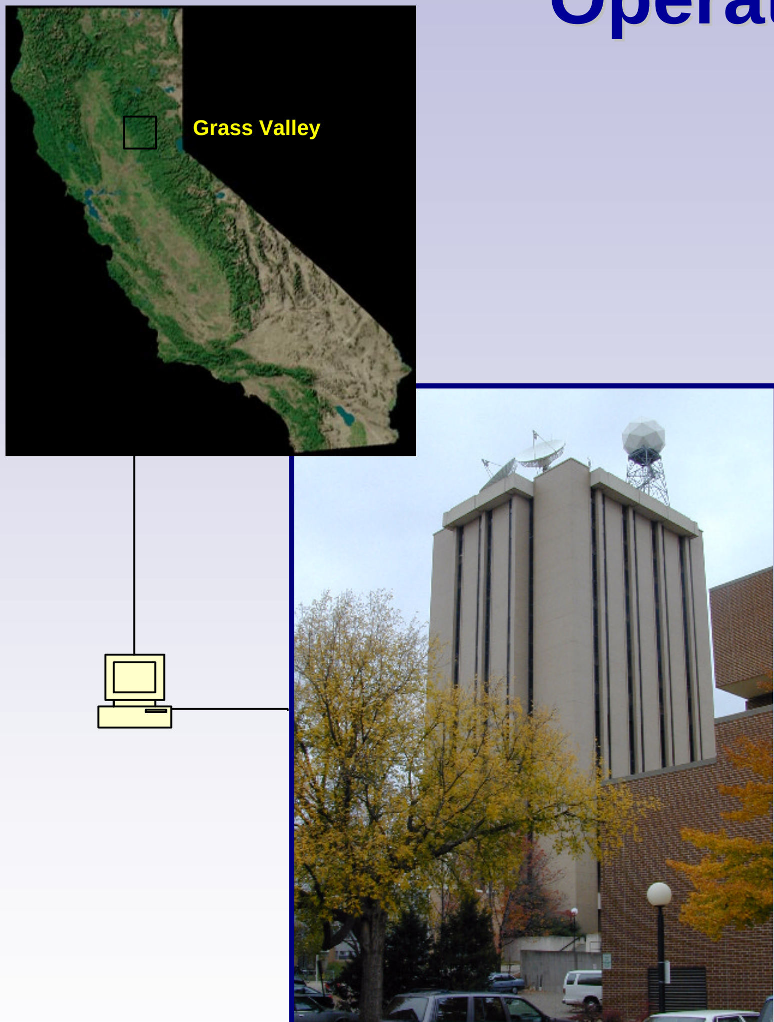
# Operational Global Geostationary Fire Network Update





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**NOAA/NESDIS/STAR/CORP**
**Advanced Satellite**
**Products Branch (ASPB)**

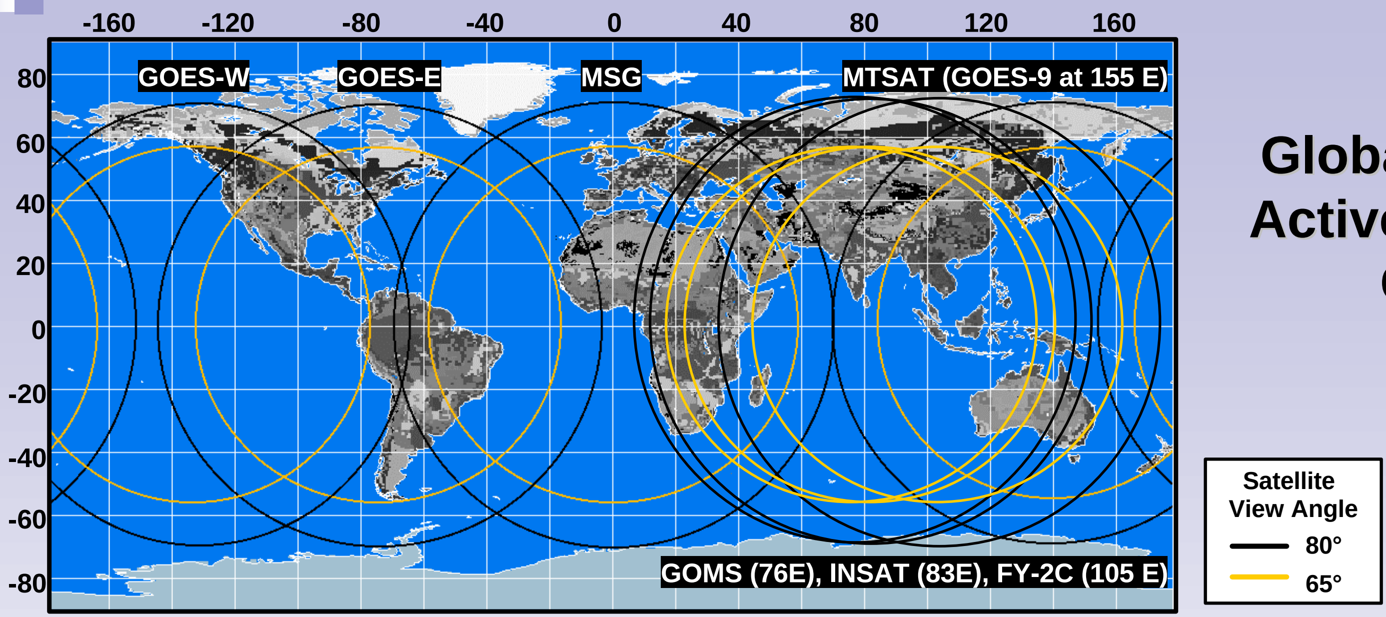
**National Aeronautics**
**and Space Administration**

**UW-Madison**
**Cooperative Institute for**
**Meteorological Satellite**
**Studies (CIMSS)**

# Overview

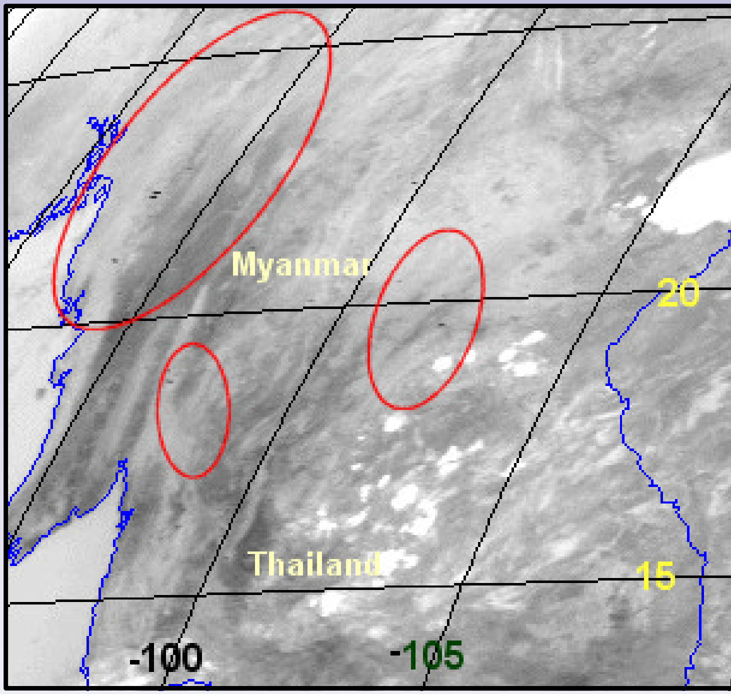
- Review of current and future geostationary platforms with fire monitoring capabilities
- Overview of Joint GOFC/GOLD Fire and CEOS LPV Working Group Workshop on Global Geostationary Fire Monitoring Applications
  EUMETSAT, Darmstadt, Germany, March 2004
- Components of Demonstration Project
- Status of algorithm development and validation
- Areas of Concern
- Current and emerging applications of global geostationary fire products

# Global Geostationary Active Fire Monitoring Capabilities



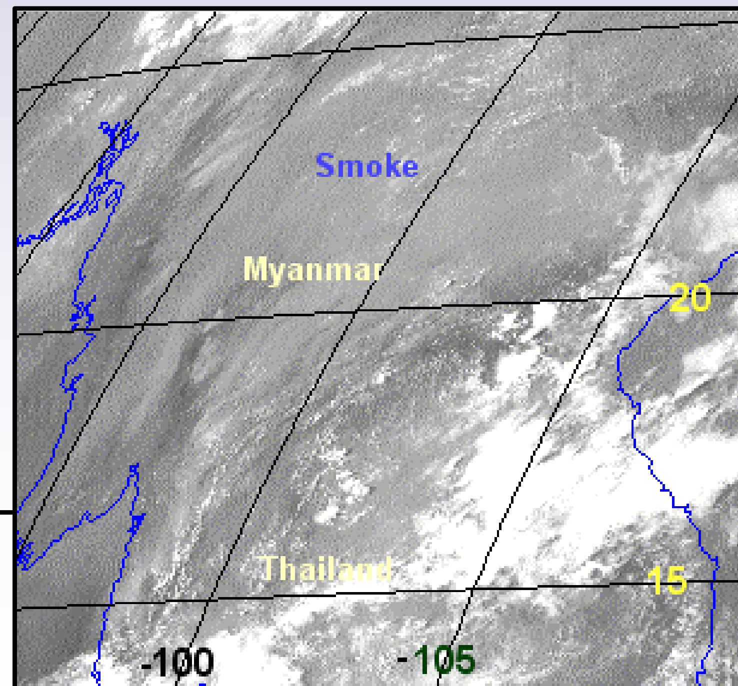

| Satellite | Active Fire Spectral Bands | Resolution IGFOV (km) | SSR (km) | Full Disk Coverage | 3.9 mm Saturation Temperature (K) | Minimum Fire Size at Equator (at 750 K) (hectares) |
|---|---|---|---|---|---|---|
| **GOES-12 Imager** | 1 visible<br>3.9 and 10.7 µm | 1.0<br>4.0 (8.0) | 0.57<br>2.3 | 3 hours | ~335 K | 0.15 |
| **GOES-9 & GOES-10 Imager** | 1 visible<br>3.9 and 10.7 µm | 1.0<br>4.0 (8.0) | 0.57<br>2.3 | 1 hour (G-9)<br>3 hours (G-10) | ~324 K (G-9)<br>~322 K (G-10) | 0.15 |
| **MSG SEVIRI** | 1 HRV<br>2 visible<br>1.6, 3.9 and 10.8 µm | 1.6<br>4.8<br>4.8 | 1.0 3.0<br>3.0 | 15 minutes | ~335 K | 0.22 |
| **FY-2C SVISSR (Fall 2004)** | 1 visible,<br>3.75 and 10.8 µm | 1.25<br>5.0 | | 30 minutes | ~330 K (?) | |
| **MTSAT-1R JAMI (2005)** | 1 visible<br>3.7 and 10.8 µm | 0.5<br>2.0 | | 1 hour | ~320 K | 0.03 |
| **INSAT- 3D (2006)** | 1 vis, 1.6 µm<br>3.9 and 10.7 µm | 1.0<br>4.0 | 0.57 ?<br>2.3 ? | 30 minutes | | |
| **GOMS Electro N2 MSU-G (2006)** | 3 visible<br>1.6, 3.75 and 10.7 µm | 1.0 km<br>4.0 km | | 30 minutes | | |

# GOES-9 Fire Monitoring in SE Asia



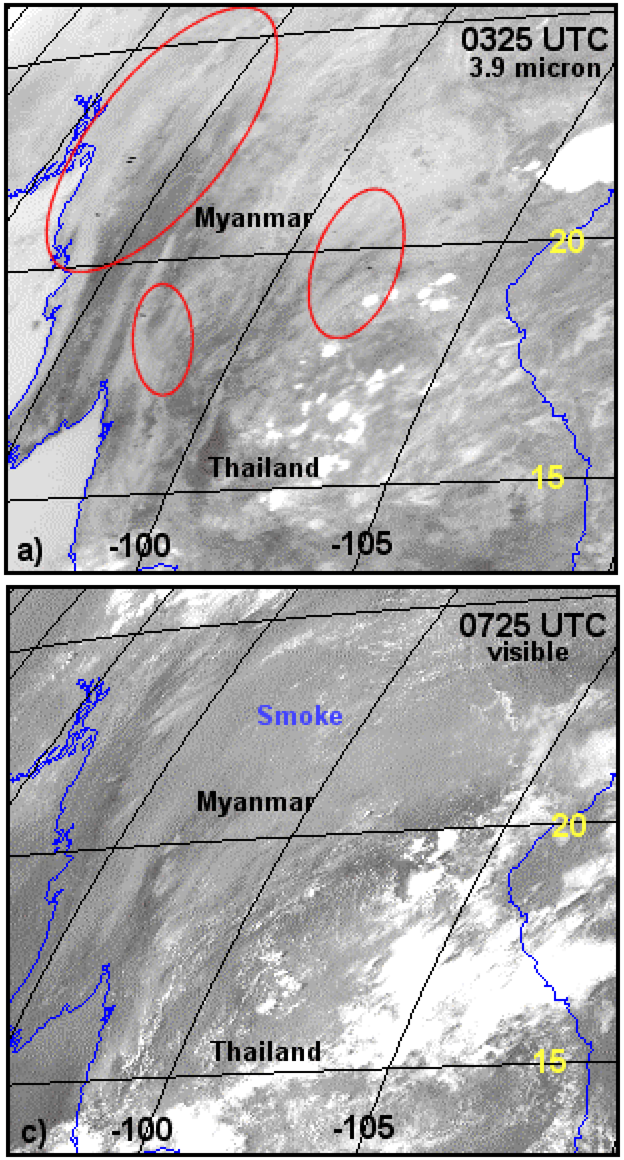

Satellite view angle: 70º

GOES-9 4 micron imagery
Date: 19- Mar-2004
Times: 0325-0725 UTC




GOES-9 visible imagery
Date: 19- Mar-2004
Times: 0725 UTC

# GOES-9 Fire Monitoring in SE Asia

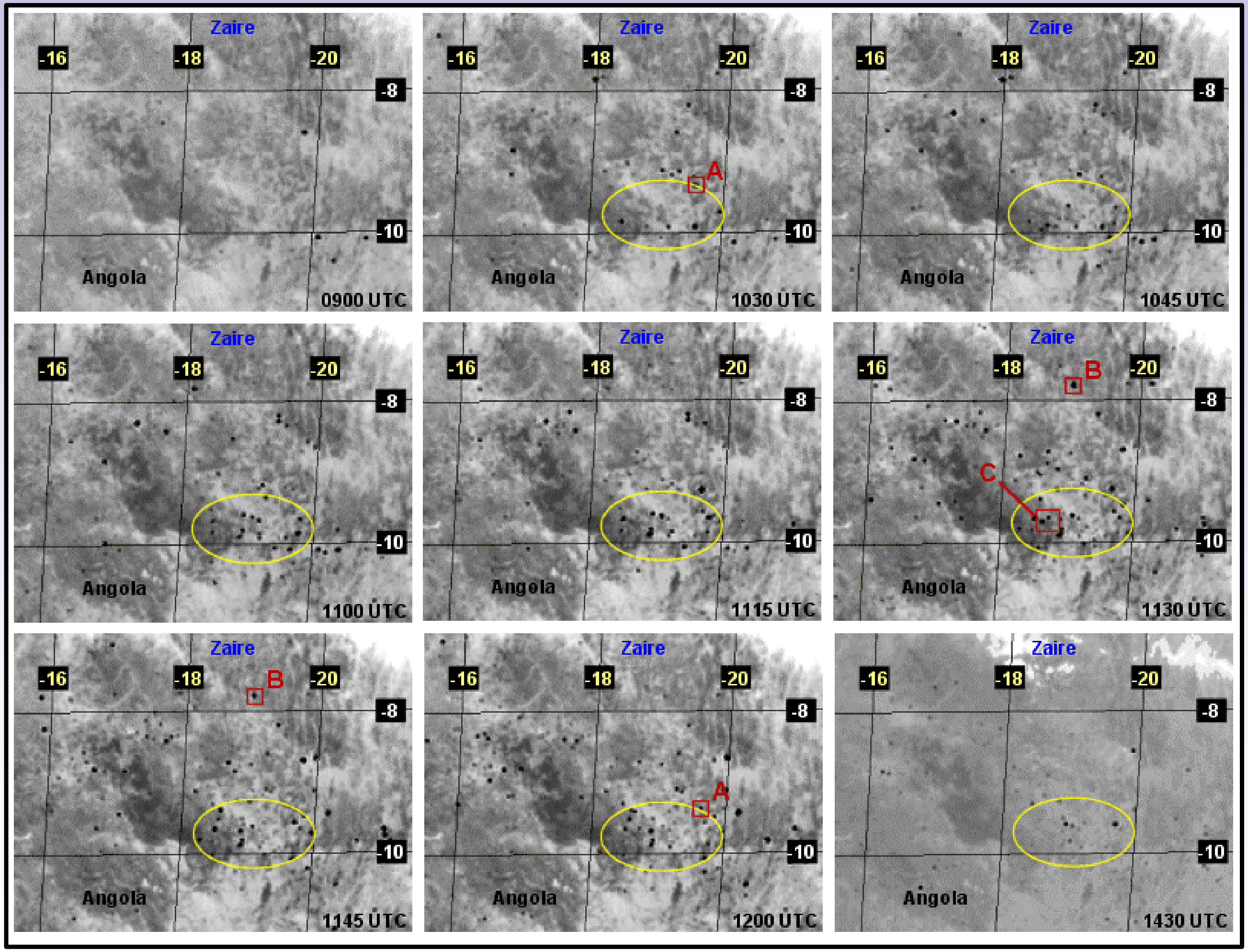



**GOES-9 Fire Monitoring in Southeast Asia**

**Date: 19-March-2004**

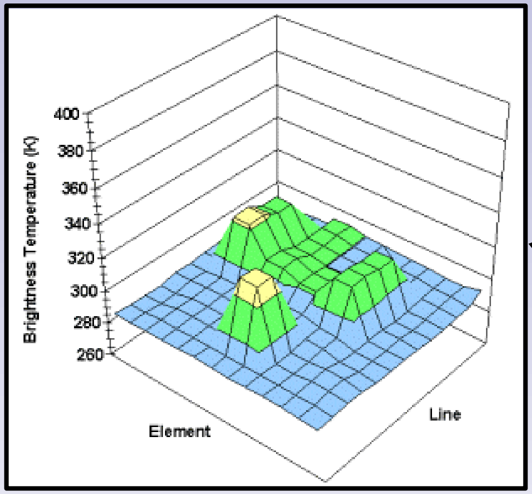
View Angle: 70 degrees

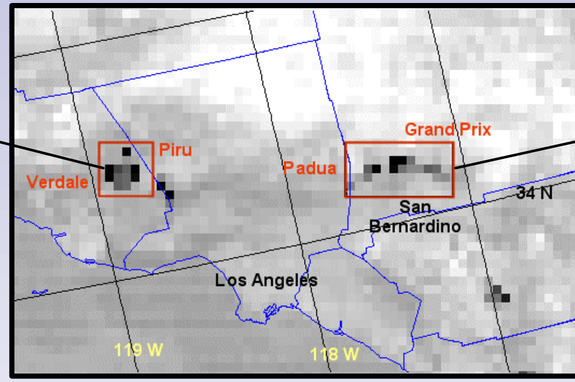
# MSG 3.9 micron Fire Observations in Africa

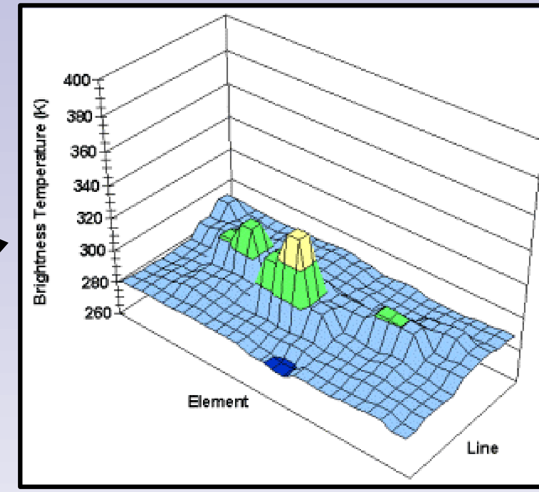


# GOES-R and GOES-I/M Simulations of Southern California Fires

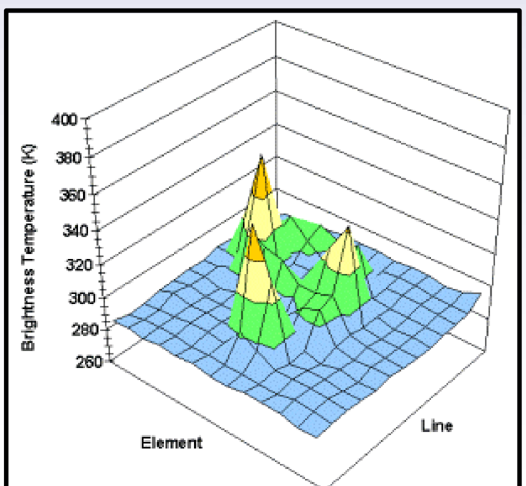
**GOES-12 Simulated 3.9 micron Data**
**Padua/Grand Prix Fires**
**Date: 27-Oct-03    Time:  09:50 UTC**

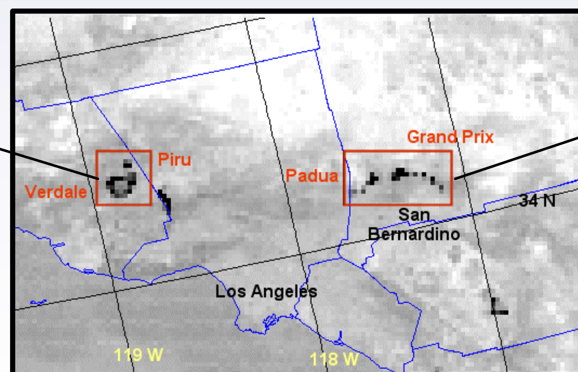


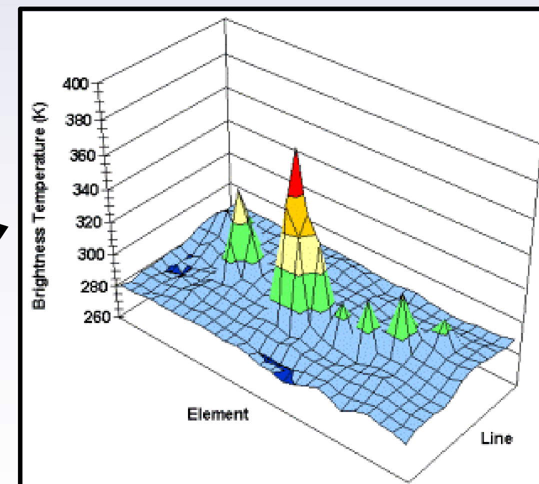




**GOES-R Simulated 3.9 micron Data**
**Padua/Grand Prix Fires**
**Date: 27-Oct-03    Time:  09:50 UTC**




**Brightness Temperature (K)**

260-280 | 280-300 | 300-320 | 320-340 | 340-360 | 360-380 | 380-400

# Joint GOFC/GOLD Fire and CEOS LPV Working Group Workshop on Global Geostationary Fire Monitoring Applications

**EUMETSAT, Darmstadt, Germany, March 2004**

## Overall Goal

*discuss, plan and coordinate the development and eventual implementation of a global operational geostationary fire monitoring applications system*

## Workshop Assessment

- Geostationary systems have an **important contribution to make to active fire and smoke detection and characterization** with applications in **fire management, emissions and air quality studies, and global change research**.

- Geostationary systems can provide **valuable diurnal information that is complementary** to fire products produced by higher resolution polar orbiting instruments.

- A **global geostationary fire monitoring network is technically feasible**, but that it **must be supported by the operational agencies** in order to sustain the activity and produce standardized long-term data records and fire inventories of known accuracy.

- In order to demonstrate the science and show the benefits and feasibility of a global geostationary fire monitoring network, a **demonstration/feasibility project** was planned.

# Components of Global Geo Demonstration Project

- Implement a ***rapid scan GOES-10/-12 Wildfire ABBA*** in the U.S. to show impact of high temporal geostationary fire monitoring capabilities on fire detection and suppression efforts. **(April ’05)**

- NOAA/NESDIS ORA and UW-Madison CIMSS will ***adapt the operational GOES-10/-12 WF_ABBA to MSG*** with an experimental version in place by June 2005 and make the MSG near real-time fire products (fire locations and sub-pixel fire characteristics) available to the EU civil protection and fire service customers during the ***summer of 2005*** to solicit their feedback and support. (**July ’05 – fire locations only**)

( EUMETSAT anticipates producing a fire product after the demonstration phase at the end of 2005 at the earliest. )

- NOAA/NESDIS/ORA and CIMSS will ***adapt the WF_ABBA to MTSAT-1R*** JAMI after launch. (**June ’05 – GOES-9 over Western Pacific; June ’06 – experimental version of MTSAT-1R, fire locations only**)

- NRL-Monterey will ***demonstrate the impact of assimilating all available global geostationary fire products*** (GOES, MSG, MTSAT-1R) into the operational NAAPS to ***diagnose and predict aerosol loading and transport***. (**June ’05 – GOES-9 over Western Pacific; September ’05 – MSG)**

- ***Validation efforts*** will be performed in coordination with the CEOS LPV working group. (**Limited effort in Acre, Brazil with CEOS LPV involvement)**

- ***Results of the demonstration/feasibility project will be documented and publicized*** to the broad community of data users for evaluation and feedback and to the operational satellite and user agencies.

# Status of Algorithm Development and Validation

## Geostationary algorithm development activities – Some interaction among groups

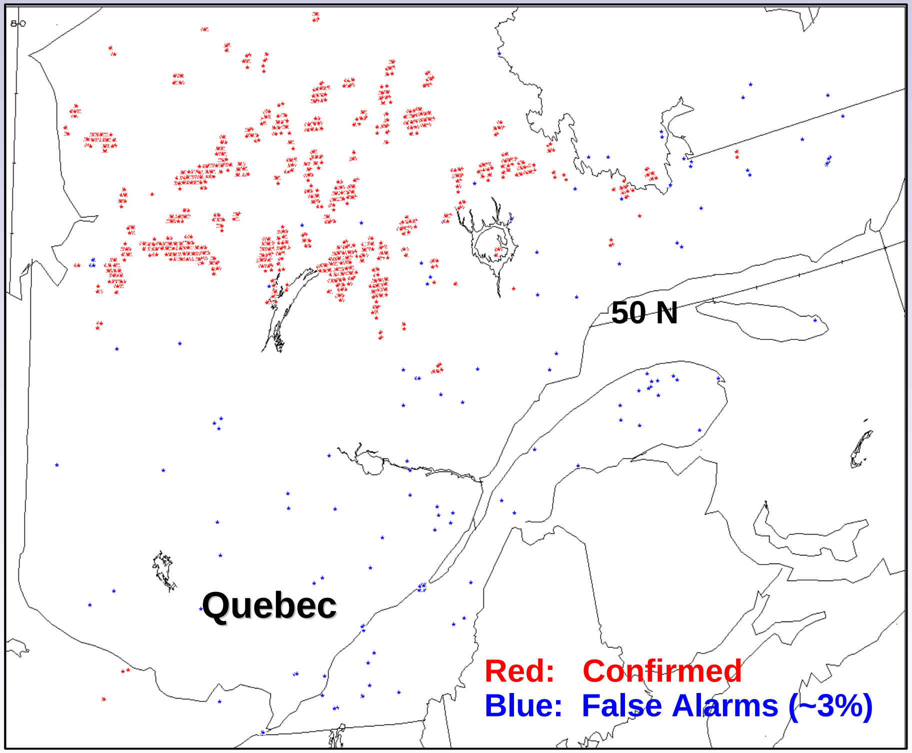
- UW Madison adapting operational contextual GOES-10/-12 WF_ABBA to GOES-9 and MSG and FRE development.
- University of Hawaii on-line geostationary fire imagery for GOES
- CSU-Colorado RAMSDIS GOES-10/-12 fire (reflectivity) imagery
- INPE GOES-12 fire detection – threshold algorithm
- Telespazio MSG experimental threshold and change detection algorithm
- Laboratorio de Teledetección (LATUV) experimental threshold algorithm for the MSG
- CSIR Satellite Applications Center South Africa MSG fire detection
- Kings College MSG fire detection and FRE algorithm development
- Mexico ?
- Argentina ?

<u>*Unaware of any groups in China, India, or Russia who are developing geostationary fire products, although they are mentioned in some of the mission overviews. Need more involvement from and interaction with these countries.*</u>

## Validation Activities – Need more interaction with CEOS LPV

- GOES WF_ABBA validation activities in collaboration with Environment Canada, Nature Conservancy, Woods Hole Research Center
- NOAA/NESDIS SSD HMS QC/validation/comparison efforts
- Multi-sensor comparisons performed by Canadian Forest Service
- Telespazio and LATUV validation efforts in Southern Europe
- CSIR validation in South Africa

# GOES WF_ABBA Validation Effort in Quebec




Courtesy of Michel Moreau

## Capabilities of the GOES WFABBA at High Latitudes in Quebec, Canada

**In the Intensive Protection Zone (South of 50 N)**

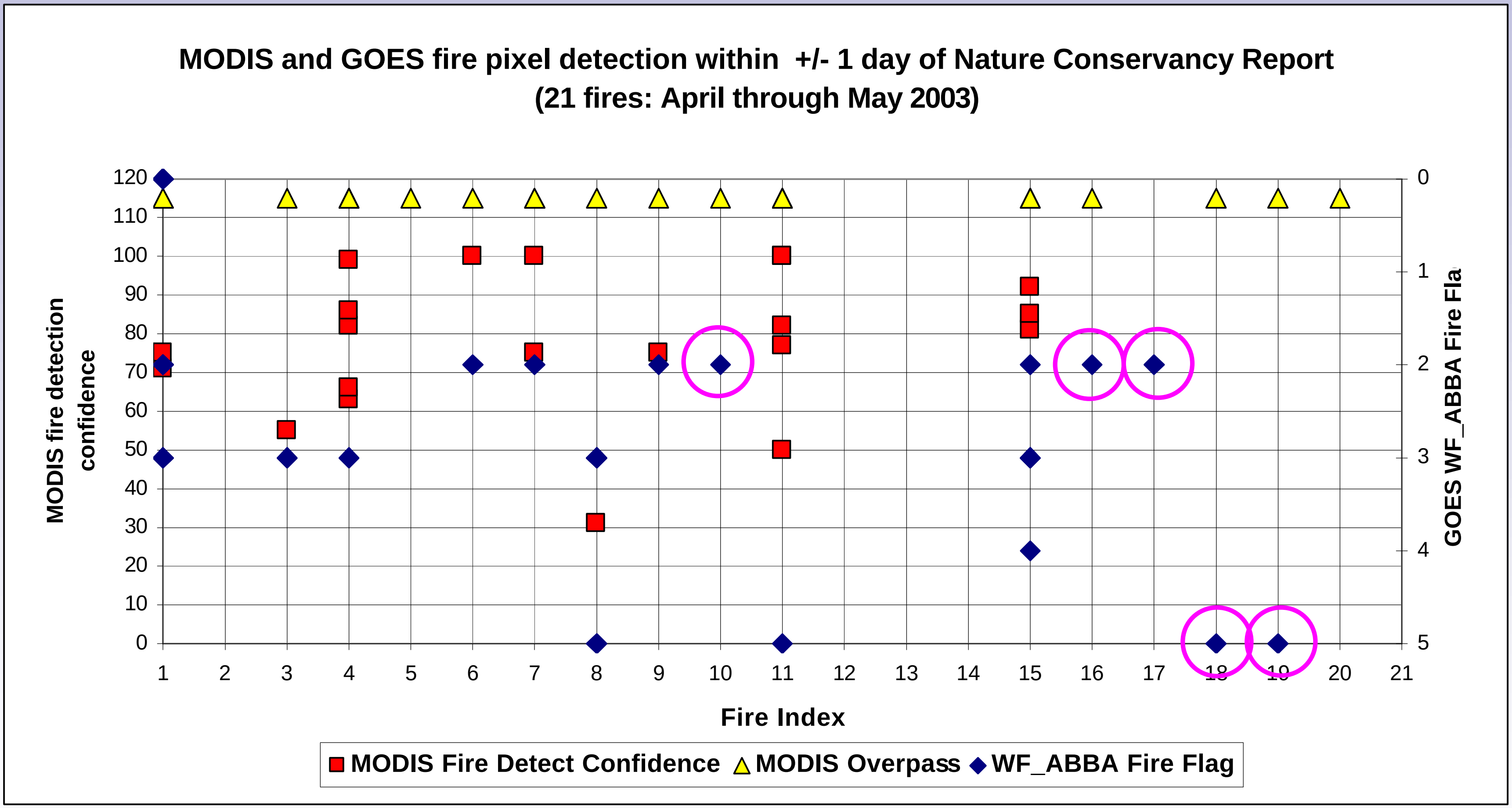
- **WF_ABBA cannot replace the expensive aircraft patrols**
- **WF_ABBA can serve as a secondary souce of information for the larger fires (represents major forest lost during a season and expensive to suppress)**
- **During 2002, WF_ABBA was quicker than SOPFEU in identifying 3 to 5 fires.**
- **WF_ABBA detected fires as small as 1 ha in size**

**In the Restricted Protection Zone (North of 50 N)**

- **WF_ABBA was quicker than the existing ground detection in more than 50% of the fires**
- **WF_ABBA detects many fires that were ignored on the ground**
- **WF_ABBA was quicker than NOAA-14 in most cases during the '99-'00 fire seasons**

**Courtesy of Michel Moreau (Env. Canada)**

# Nature Conservancy GOES WF_ABBA Validation Effort in Northern Plains



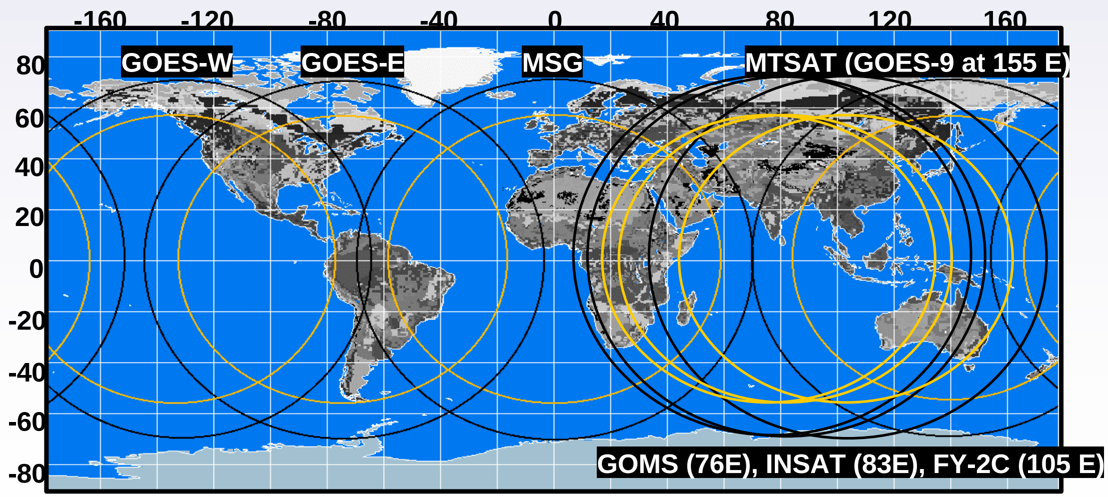

## GOES WF_ABBA Fire Categories

0 – Processed Fire Pixel    1 – Saturated Fire Pixel    2 – Cloudy Fire Pixel
Possible Categories: 3 – High    4 – Medium    5 – Low

Ground truth information courtesy of J. Eerkes, Nature Conservancy

# Some Areas of Concern

- Support/commitment from operational agencies
- Need more involvement from Africa, eastern Europe, Asia, and Australia especially with the recent/near-term launch of FY-2C, MTSAT-1R, INSAT-3D, GOMS Electro N2.
- Need for more systematic validation efforts to understand cross platform differences and coordinated validation activities with CEOS LPV
- Need R&D in the area of fused polar and geostationary fire products with the goal of improved merged products. This includes fire location and characterization (e.g. Dozier vs. fire radiative power)
- Each platform in the global geostationary network has unique fire detection and characterization capabilities. How do we characterize these differences and create a consistent global product?
- So much to do ….. so few working in the field of geostationary fire development, validation, and implementation

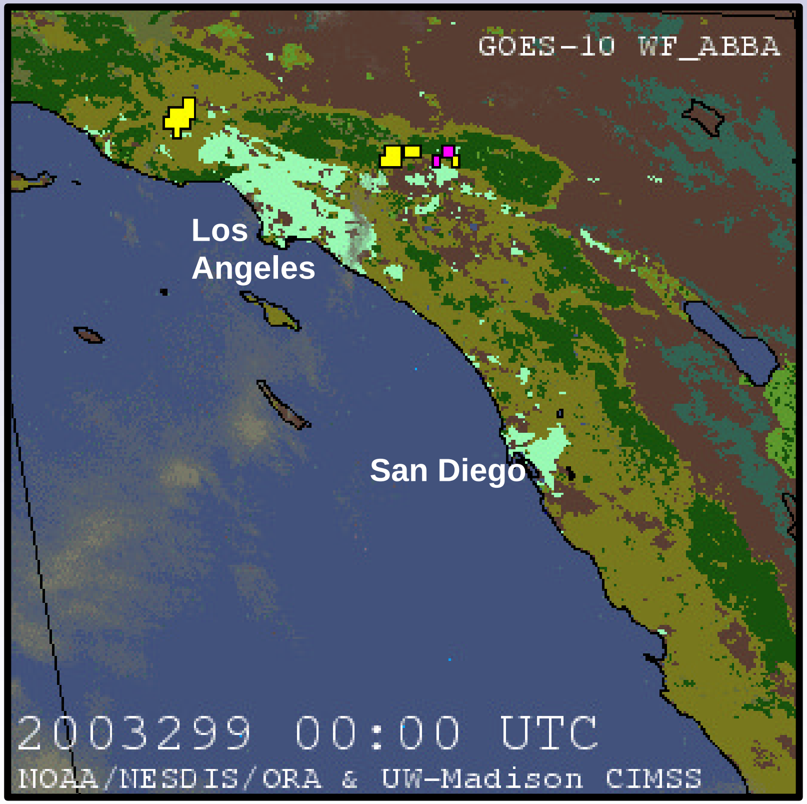



# Applications of the GOES WF_ABBA

# GOES WF_ABBA Diurnal Monitoring of Wildfires In the Western U.S.

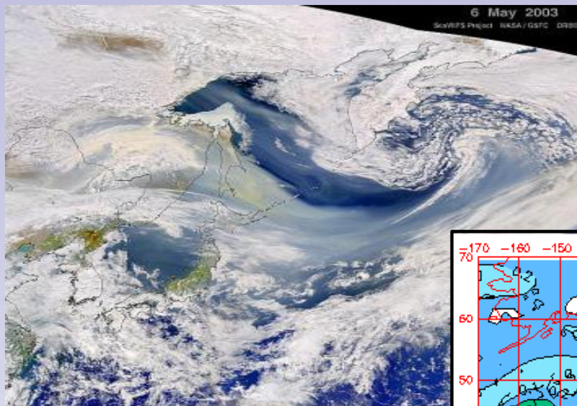
- Half-hourly GOES alpha-blended imagery and fire products provide insight into diurnal variation in fire intensity and weather
- Currently products are available on-line within half-hour of image receipt
- Goal is to provide fire products within 5 minutes for regional sectors in rapid scan mode this year. Rapid scan mode can be requested by the fire weather community.

**GOES-10 WF_ABBA Alpha-Blended Imagery (GOES Visible, IR, WF_ABBA, USGS GLCC)**

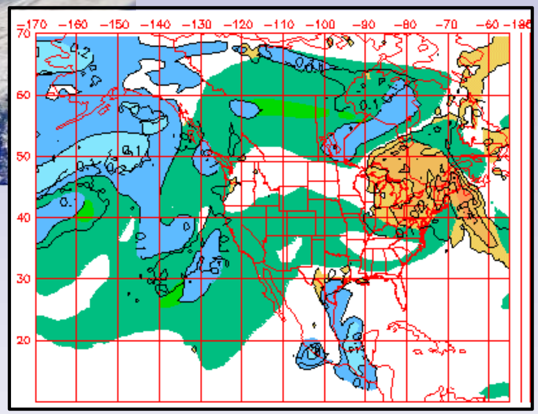


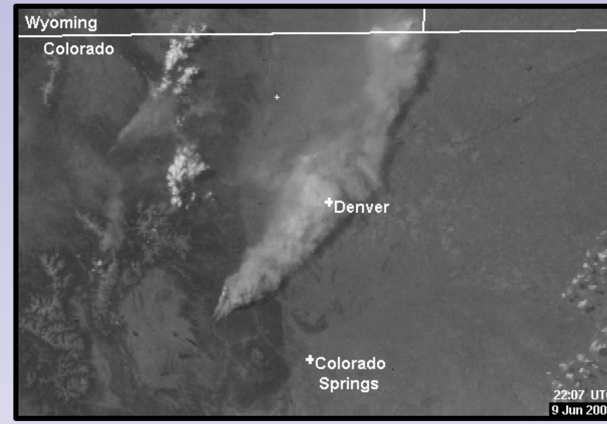

26 October – 29 October 2003

# Where are Biomass Burning Aerosols Coming From and Where are They Going?




Smoke Transport Across Pacific from Siberia 6 May 2003

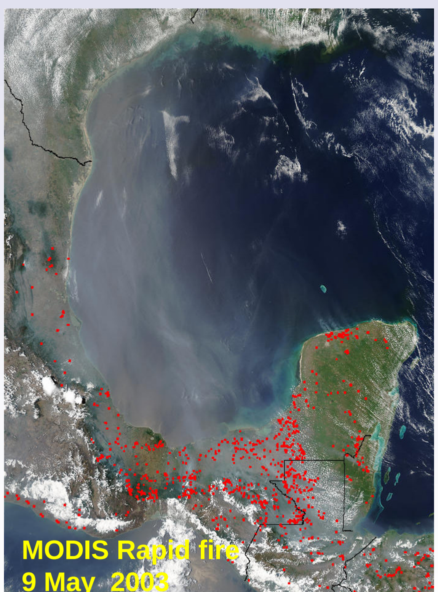




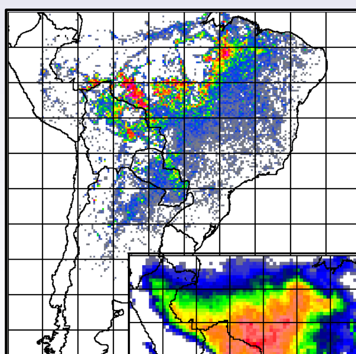

GOES-11 Rapid Scan Visible Imagery (1 km)
22:07, 9 June 2002 – 00:50, 10 June 2002
Courtesy of CSU - CIRA

Before

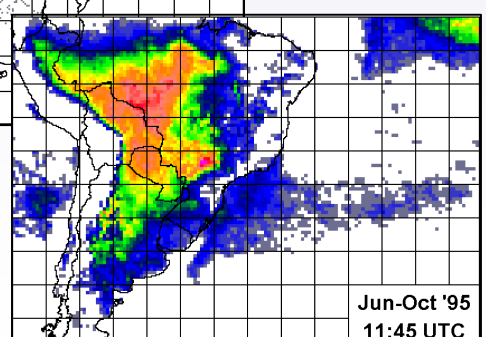
After



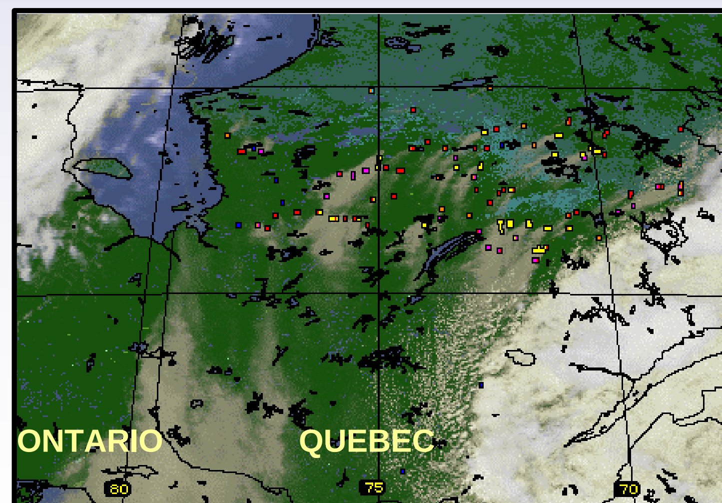

Smoke Transport Across Gulf of Mexico 9 May 2003



GOES Fire Product Jun-Oct 1995



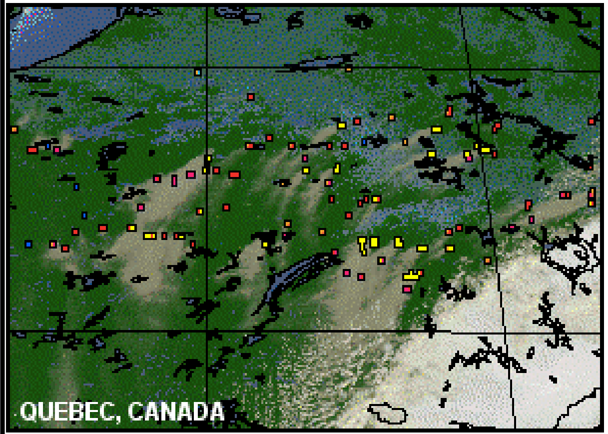

GOES Smoke Coverage




Wildfires in Quebec, Canada
6 July 2003 at 17:45 UTC

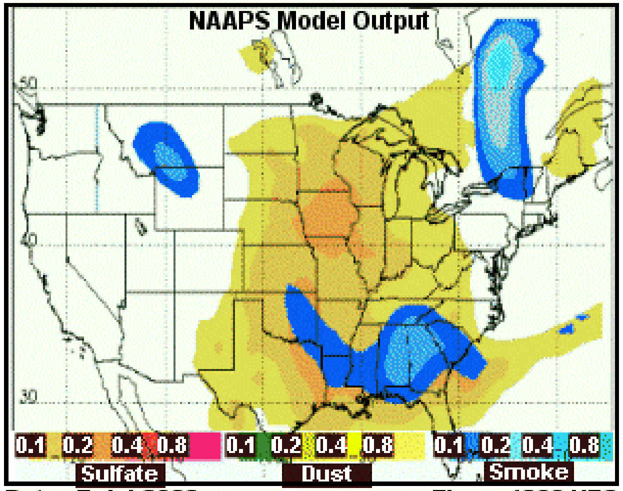
# Model Data Assimilation of the GOES WF_ABBA Product

Real-time assimilation of the Wildfire ABBA fire product into the NRL NAAPS Model to diagnose and predict aerosol loading and transport.



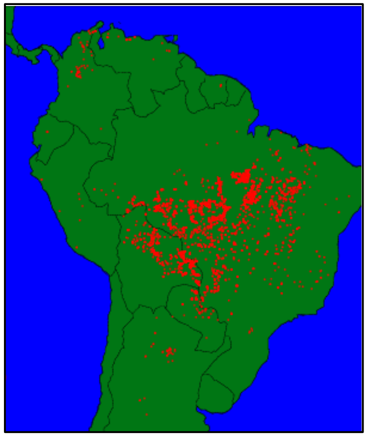

Wildfire ABBA Fire Product
Date: 6-Jul-2002
Time: 17:45 UTC

NOAA/NESDIS/ORA ASPT UW-Madison CIMSS

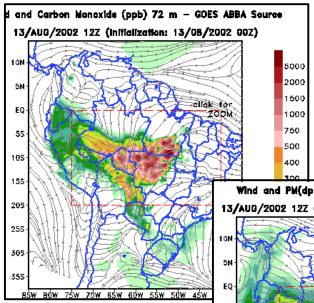



Date: 7-Jul-2002 Time: 1200 UTC

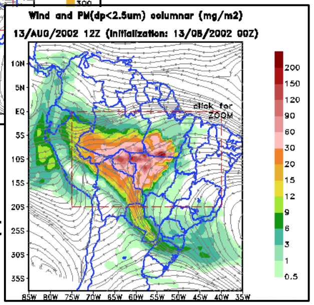
Navy Aerosol Analysis and Prediction System (NAAPS)
Courtesy of Doug Westphal, NRL, Monterey, CA



GOES-8 WF_ABBA Fire Product
Point Sources for 13 August 2002

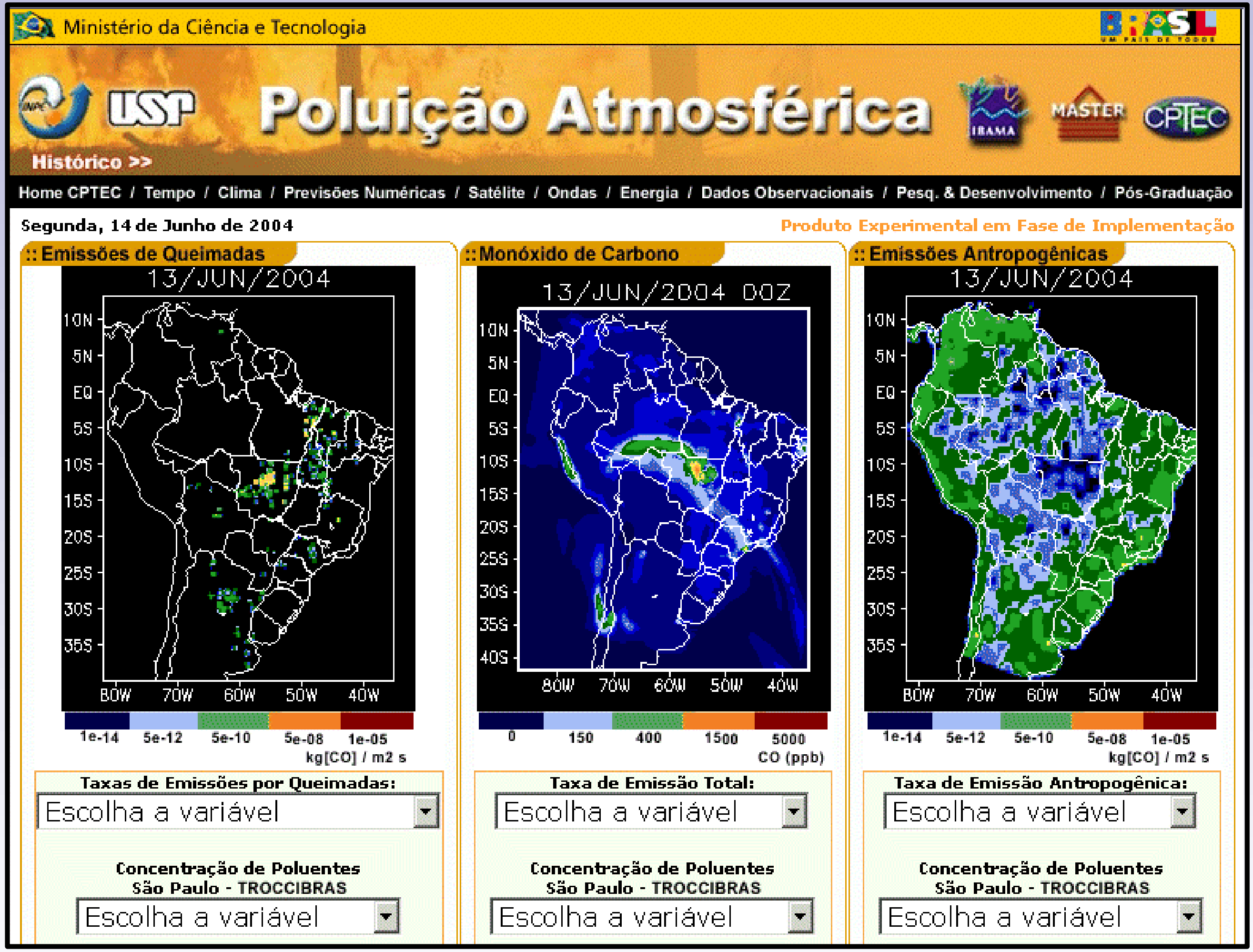



RAMS
CO Product




RAMS
PM2.5 Product

Real-time assimilation of the GOES Wildfire ABBA fire product into the RAMS model at INPE/CPTEC to assess CO and PM2.5 associated with biomass burning.



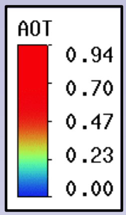

http://tucupi.cptec.inpe.br/meio_ambiente/

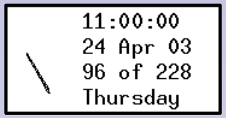
**Monitoring the Transport of Biomass Burning Emissions in South America**

(Accepted by Environmental Fluid Mechanics, May 2004)

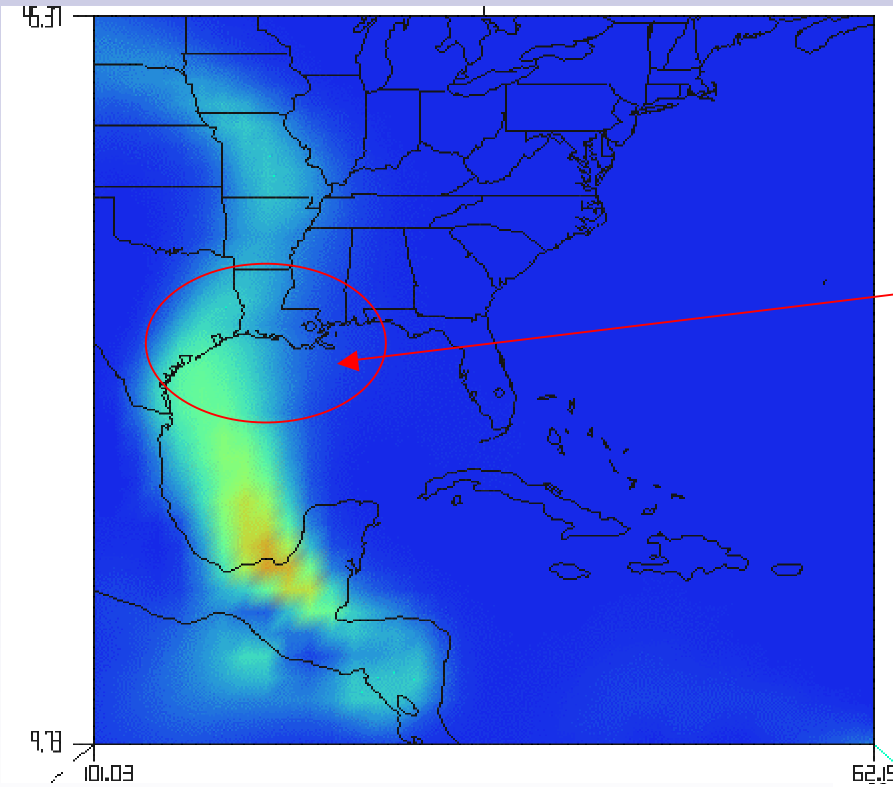
Saulo R. Freitas, Karla M. Longo, Maria A. F. Silva Dias, Pedro L. Silva Dias, Robert Chatfield, Elaine Prins, Paulo Artaxo, Georg Grell, Fernando S. Recuero

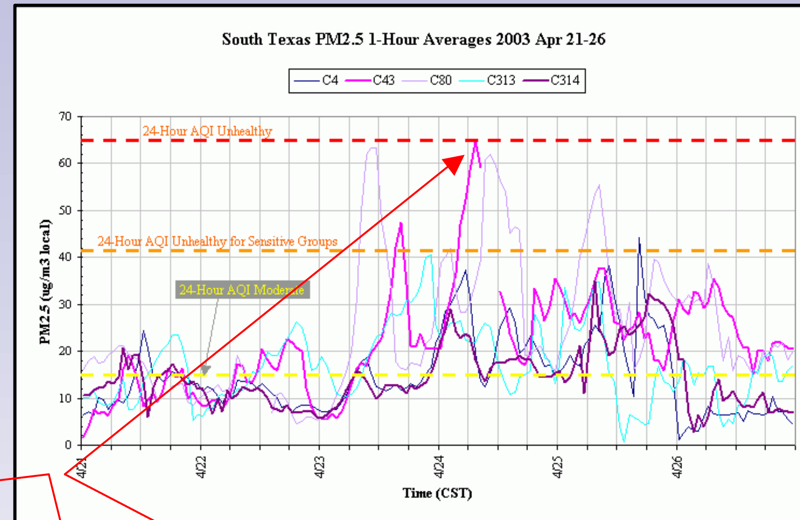
# Application of the GOES WF_ABBA to Monitor Smoke Events in Southern Texas

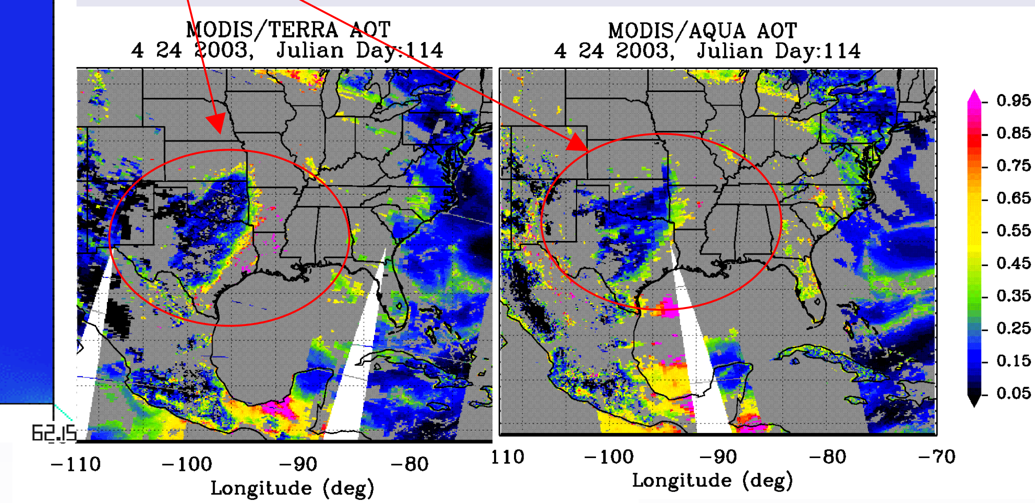



**Health alert is issued & News is released**




Jun Wang, U.S.Nair, Sundar A Christopher, Richard T. McNider, Jeff Reid, Elaine M. Prins, and Jim Sykzman: An Integrated System for Studying the effect of Central American smoke aerosols on air quality and climate over the Southeastern United States, 13th Conference on Satellite Meteorology and Oceanography, 20–24 September 2004, Norfolk, Virginia.